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thickness and to use semi-insulating material to provide low leakage current. I-V characteristics of such type of detectors have unusual view. Most commonly, rectification at low voltages is not observed and forward current steeply increases starting from a few volts rather than at voltage lower than built-in potential. In our contribution we show that electrical characteristics of diodes based on semi-insulating CdTe can be improved using electrode metals with high work functions (Au, Pt, Ni) instead of commonly used In. Both rectifying and near-ohmic contacts were obtained by vacuum deposition of Ni on the opposite crystal surfaces pre-treated by Ar ion bombardment. Ohmic contacts were obtained at the ion beam density 10-15 mA/cm^2 and ion energy 400-500 eV, while Schottky contacts were formed at the ion beam density 2-5 mA/cm^2 and ion energy 700-800 eV. The fabricated Ni/CdTe/Ni detectors exhibit pronounced rectification in the low-voltage region where the I-V characteristics are quantitatively described by the Sah-Noyce-Shockley theory. The deviation of the reverse I-V characteristics from the dependence predicted by the theory can be explained by injection of minority carriers in the neutral part of the diode. The used technological procedures allowed us to decrease significantly dark current of detectors. Leakage current density of the developed diodes at room temperature is ~10 nA/cm^2 at bias voltage 1000 V and even higher. These parameters are superior to those of the detectors presented in the literature.

R12-67: Low-Resistivity CdTe-Based Schottky Diodes for X- and γ -Ray Detectors

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Relatively low resistivity ($\rho = 10^2$-10^3 Ω cm at 300 K) n-CdTe crystals with a Schottky contact are studied to be used in X- or γ-ray detector performance. Schottky and ohmic contacts were fabricated by vacuum evaporation of Ni and In, respectively. Before electrode deposition, the corresponding surfaces of CdTe crystals were subjected to special processing including chemical treatment and etching in argon atmosphere. On the base of electrical measurements, the charge transport properties are discussed and charge-collection processes in the n-CdTe-based Schottky diodes are analyzed. The dependencies of the charge-collection efficiency in the detectors on the carrier lifetime and concentration of uncompensated donors are obtained and the conditions for the total collection of charges generated by the photon absorption are established. Taking into account drift and diffusion photocurrent components, the spectral distribution of the quantum detection efficiency is calculated. The fabrication of detectors on the basis of low-resistivity CdTe has some advantages because it is easier to make non-injecting contacts to the semiconductor and no particular problems to form a rectifying contact with a significant band bending at the semiconductor surface. The total charge collection at the photon absorption occurs at low reverse bias and an increase in voltage results in only an extension of the detector active thickness. The obtained results show that the Schottky diodes fabricated on the basis of CdTe with resistivity of 6-7 orders of magnitude lower than that of commonly used semi-insulating material have electrical characteristics comparable to those of high-resistivity CdTe-based Schottky diode detectors. Moreover, the use of low resistivity CdTe can avoid polarization effects in detectors. The sensitivity of Schottky diode detectors in the high-energy spectrum region can be increased using several stacked diodes.

R12-68: Study of Surface Treatment Effects on the Metal-CdZnTe Interface

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The metal-CdZnTe interface is one of the dominant factors influencing detector performances. Electroless deposition usually produces good current voltage characteristics, but it is hardly compatible with photolithography. In this work it has been investigated the influence of different surface treatments on the electrical properties of the metal-CdZnTe interface. The study was performed on Cd0.9Zn0.1Te grown by Boron Oxide Encapsulated Vertical Bridgman technique. Samples of nearly 7mm x 7mm x 1.5mm were cut out of the grown ingots. Contacts were prepared using different procedures and current-voltage characteristics were recorded to monitor the effect of different surface treatments on the electrical characteristics of the device. The preparation procedures studied in this work concern: i) surface etching with Br-methanol ii) surface etching with a solution of bromine, lactic acid, and ethylene glycol iii) the growth an oxide layer for surface passivation by using a solution of 10% wt NH4F, 10% wt H2O2, and de-ionized water iv) gold thermal deposition v) thermal treatment of contacts. A proper choice of the process parameters permits to strongly limit the leakage current. After this study, it has been possible to fix an optimal configuration for CdZnTe based devices, which comprehends surface oxidation, the guard ring and the thermal treatment. The final current-voltage characteristics can be described by two diodes in configuration back to back.